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Two new books on plant physiology.³

THE dearth of text-books on plant physiology seems about at an end. We record with pleasure the almost simultaneous publication of two books on this subject, one by Professor D. T. MacDougal, of the New York Botanical Garden, the other by Professor W. F. Ganong, of Smith College. It is significant that both these books are American.

The first named volume comprises a very comprehensive, though necessarily brief, account of the phenomena of plant physiology, together with explicit directions for laboratory experimentation. Discussion of principles and laboratory directions are so interwoven that the temptation for the student to work mechanically, without other end in view than to finish the experiment, must here be reduced to a minimum. For this reason the book may be found more useful on the laboratory table than in the reading room. The mere reader will often be disappointed by the absence of measurements, etc., since it is intended that these shall be obtained in the laboratory. On the other hand, it will be well-nigh impossible for one to peruse any section without gaining a fair knowledge of the methods by which the principles there treated are established.

After an introductory chapter on the nature and relations of an organism (in which many statements are unavoidably made which the student cannot understand until he has gone further) the author devotes seven chapters to the presentation of the subject of irritability. In each of these a group of external conditions and the influence of these upon the plant is taken up. These chapters are headed as follows: Relations of plants to mechanical forces, Influence of chemicals upon plants, Relation of plants to water, Relation of plants to gravitation, Relation of plants to temperature, Relation of plants to electricity and other forms of energy (although there are no "other forms" mentioned here), and Relations of plants to light. The chapter on the influence of chemicals will be found especially valuable. The next chapter (IX) deals with the composition of the body, and consists of a very brief treatment of the different groups of compounds found in the plant, followed by methods for their extraction, separation, and identification. This discussion is so brief that the reader may be led into error by generalizations; and students will need to be cautioned that the qualifying phrases in the chapter are very important.

Following this are five chapters on the processes going on within the living plant. These are entitled: Exchange and movements of fluids, Nutritive metabolism, Respiration, Fermentation and digestion, Growth, and

³MACDOUGAL, D. T.: Practical text-book of plant physiology. 8vo. pp. xiv + 352. *figs.* 159. New York: Longmans, Green & Co., 1901.

GANONG, W. F.: A laboratory course in plant physiology, especially as a basis for ecology. 8vo. pp. vi + 147. *figs.* 35. New York: Henry Holt & Co., 1901.

Reproduction. The treatment of enzymes, which have become so important a consideration within the last few years, is comparatively full, both in the chapter on the composition of the plant and in that on nutrition, and will be especially useful.

Following the chapters on processes within the plant, the last chapter in the book gives a very excellent exposition of the subject of vegetative propagation throughout the plant kingdom. Sexual reproduction is not treated. At the end is a valuable appendix containing tables of physical constants, such as the expansion of air at different temperatures from 0° to 35° , the density of oxygen and of carbon dioxide, the absorption of these gases by water, etc. It will be a great aid, in experiments where calculation is necessary, to have these tables in a convenient form for reference.

Regarding the style, we wish it might have been clearer in places; there will surely arise difficulties of interpretation now and then. The only important point of theory wherein the author may find others in disagreement with him is that which expresses itself here and there in the idea of some *purpose* underlying the whole field of plant phenomena. For instance, it is stated that there exist "reactions to shock . . . which the most thorough investigation has failed to invest with a purpose. New relations of the plant may be discovered, however, which will interpret these reactions."

The book is fully illustrated throughout, including many figures of apparatus. References to the most important recent publications on the different topics are given as footnotes, and both treatment and references are surprisingly up to date, articles being cited which appeared only a few months ago. The index is complete, and includes footnotes as well as text. The arrangement of the subject-matter is thoroughly scientific, which fact, together with its general completeness and reliability, should give the book a broad and constant use in laboratories where the subject is taught.

Professor Ganong's new book does not attempt to present any general discussion of the subject, but is designed, as its title denotes, for laboratory use only. It is divided into two parts, the first being on methods of study and necessary equipment, while the second comprises the true outline of the course. Part I is written largely for the teacher, and every teacher of laboratory science (whether it be physiology or not) will do well to read it. The first two sections of this part are especially noteworthy for their fund of pedagogical ideas, which, it seems to us, are almost all philosophically and practically sound. The third and fourth sections deal with laboratory, greenhouse, and materials for the course. Section 5 gives practical directions for a great number of laboratory manipulations, some of which often are a source of considerable trouble to the inexperienced. This will surely prove a very valuable part of the book.

Part II, the outline of the course itself, consists of two divisions. Division

It treats of the structure and properties of protoplasm, including its composition, its relation to external conditions, and its power of organism building. Division II deals with the physiological operations of plants. Here are included nutrition, growth, reproduction, irritability, locomotion, and protection. The last two are not treated, however, the statement being made that they are almost purely ecological in their nature.

The titles of the exercises throughout this entire part are put in the form of questions. The directions which follow are designed to aid the student in answering the question, but do not answer it for him. Just enough discussion is brought in with the laboratory directions to arouse the student's interest in the experiment in hand, and to make him appreciate what are its essential points. Ample references to the literature are constantly given, even to original articles; the author believes that direct contact with the sources of information is of great pedagogical value. Good half-tone reproductions of photographs show the student just how the more complicated forms of apparatus are to be set up. With their aid he should be able to bring his experiment to completion with a minimum amount of aid from the teacher.

Following this part are several pages of addenda in which are noted numerous improvements upon apparatus described in the body of the book.

The course as outlined by Professor Ganong will doubtless occupy more time than many can give to an elementary course in plant physiology. For such teachers the book will still be useful, since it is so well arranged that one can easily strike out a topic here and there without materially affecting the course as a whole. The style is clear, vivid, and scholarly throughout. We can think of no book yet published which might better "serve as a guide to the acquisition of a general physiological education."—BURTON EDWARD LIVINGSTON.

MINOR NOTICES.

THE *Transactions* of the American Microscopical Society 21: 1900, contains 275 pages devoted largely to zoological papers and matters of general interest. The following are of special interest to botanists: C. A. KOFOID, *The plankton of Echo river, Mammoth cave*; HENRY B. WARD, *Comparative study of methods in plankton measurements*; GEORGE C. WHIPPLE, *Chlamydomonas and its effect on water supplies*; CHARLES E. BESSEY, *The modern conception of the structure and classification of diatoms*, with a division of the tribes and a rearrangement of the North American genera. Professor Bessey accepts Müller's view that the filamentous condition is the primitive one, and that diatoms should be regarded as typically filamentous rather than as unicellular forms. They should then be classed between the Peridinales on the one hand, and the Desmidiaceae and Zygnemaceae on the other. The Zygnemaceae are regarded as the most primitive